Remarks

Applicant respectfully requests favorable reconsideration of this Response and Amendment, as well as consideration of the pending claims as amended herein. The Examiner is encouraged to contact the undersigned by telephone to facilitate any remaining questions or issues.

Status of Pending Claims:

Claims 216-220, 222-229, 231-232, 235, 237-253, 258-260, 342 and 350 are pending in this application.

Claims 216, 222-223, 227-229, 231-232, 235, 243, 247, 252-253, 259-260 and 342 are (Currently amended).

Claims 218-219, 224, 237, 239-242, 244, 248-250, 258 and 350 are (Previously presented).

Claims 217, 220, 225-226, 238, 245-246 and 251 are (Original).

There are no claims which are (New).

Claims 1-215, 221, 230, 233-234, 236, 254-257 are (Canceled).

Claims 261-341 and 343-349 are (Withdrawn).

Amendments to the Claims:

Clarifying amendments have been made to claims 216, 222-223, 227-229, 231-232, 235, 243, 247, 252-253, 259-260 and 342.

Summary of Examiner's Claim Rejections:

Claims 216-220, 222, 224, 328-240, 243, 248-254, 256, 258, 342, are rejected under 35 U.S.C. 102(b) as being anticipated by US 4841731 (Tindell). Claims 216-220, 222, 224, 328-240, 243, 248-254, 256, 258, 342, are rejected under 35 U.S.C. 102(b) as being anticipated by US 3459953 (Hughes). Claim 223 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5388395 (Scharpf et al). Claims 225-227 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5899072 (Gode). Claims 230-236 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5516359 (Kang et al). Claim 237 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 4440545 (Weidig). Claim 241 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 3975913 (Erickson). Claims 242, 259-260, are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell). Claims

244-247 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 6698183 (Thordarson). Claim 242 is rejected under 35 U.S.C. § 103(a) as being unpatentable over (Tindell) in view of U.S. 2406605 (Hurd et al.). Claims 259, 260 and 350 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 6212876 (Gregory et al.).

Marked-up Set of Claims (According to 37 CFR 1.121(c))

Claims 1 – 215 (Canceled)

216. (Currently amended) An engine comprising a combustion camber, wherein ~~fuel~~ a mixture of oxygen, as O_2, and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air ~~and hydrogen are combusted in a combustion chamber~~, ~~and~~ wherein

said separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

217. (Original) The engine of claim 216, wherein mechanical rotating energy is created.

218. (Previously Presented) The engine of claim 217, wherein said rotating mechanical energy turns a generator to create electrical energy.

219. (Previously Presented) The engine of claim 216, wherein the steam produced by combustion turns a steam turbine, and wherein

said steam turbine turns a generator to create electrical energy.

220. (Original) The engine of claim 216, wherein heat is created.

221. (Canceled)

222. (Currently amended) The engine of claim 218 or 219, wherein at least a portion of said electrical energy is used in the electrolysis of water to hydrogen and oxygen, and wherein

at least a portion of at least one of said hydrogen and oxygen is used in said mixture~~engine~~.

223. (Currently amended) The engine of claim 216, further comprising ~~wherein~~ nitrogen or argon ~~is~~ in said ~~fuel~~ mixture.

224. (Previously Presented) The engine of claim 216, wherein said oxygen further comprises air.

225. (Original) The engine of claim 216, wherein at least a portion of the steam produced by combustion is converted to hydrogen by the corrosion of at least one metal.

226. (Original) The engine of claim 225, wherein the conversion of said steam into said hydrogen is increased by an electrical current in said metal(s).

227. (Currently amended) The engine of claim 225 or 226, wherein said hydrogen is at least partially used ~~as fuel~~ in said mixture~~engine~~.

228. (Currently amended) The engine of claim 216, wherein a generator turns due to the movement of air or water, and wherein

said generator creates electrical energy, and wherein

said electrical energy is at least partially utilized in the electrolysis of water to hydrogen and oxygen, and wherein

at least a portion of at least one of said hydrogen and oxygen is used ~~as fuel~~ in said mixture~~engine~~.

229. (Currently amended) The engine of claim 216, wherein a photovoltaic cell creates electrical energy, ~~and~~ wherein

said electrical energy is at least partially used in the electrolysis of water to hydrogen and oxygen, and wherein

at least a portion of at least one of said hydrogen and oxygen is used in said ~~engine~~mixture.

230. (Canceled)

231. (Currently amended) The engine of claim 2[[30]]16, wherein at least a portion of the nitrogen separated from air in said cryogenic air separation unit is used to cool any portion of

at least one selected from a list consisting of: said cryogenic air separation unit, the storage of oxygen, the storage of hydrogen, electrolysis, coolant for said engine, said engine and any combination thereof.

232. (Currently amended) The engine of claim 23[[0]]1, wherein saidthe nitrogen separated from air in said cryogenic air separation unit is at least partially used to cool air or water.

223 – 234. (Canceled)

235. (Currently amended) The engine of claim 21630, 233 or 234, wherein saidthe oxygen separated from air is at least one of enriched oxygen, pure oxygen and very pure oxygen.

236. (Canceled)

237. (Previously Presented) The engine of claim 216, wherein at least one selected from a list consisting of a: corrosion inhibitor, chelant, dispersant and any combination therein is added to at least a portion of the water in said engine.

238. (Original) The engine of claim 216, wherein said engine performs at least one of: internal, turbine and heating combustion.

239. (Previously Presented) The engine of claim 216, wherein at least one of oxygen and hydrogen is stored in at least one of a cooled gas state and a liquid state by liquefaction.

240. (Previously Presented) The engine of claim 239, wherein compressor(s) for at least one of cooling and liquefaction is powered by at least one of said engine and a fuel cell.

241. (Previously Presented) The engine of claim 240, wherein said fuel cell is powered by hydrogen and at least one of oxygen and air.

242. (Previously Presented) The engine of claim 216, wherein at least one of said hydrogen and oxygen is stored in a mixture with frozen water crystals to form a gel.

243. (Currently amended) The engine of claim 216, wherein at least one selected from a list consisting of: hydrogen, oxygen and water is[[are]] preheated prior to combustion with the energy from at least one selected from a list consisting of: ambient temperature, said engine, said engine exhaust, an electrical radiant heat source and any combination therein.

244. (Previously Presented) The engine of claim 217, wherein said mechanical rotating energy from said engine enters a transmission, wherein

said transmission engage in a manner that is inversely proportional to at least one of the torque and work output of said engine, and wherein

said transmission output mechanical rotating energy turn a generator to create electrical energy.

245. (Original) The engine of claim 244, wherein said transmission engage a flywheel capable of storing rotational kinetic energy, wherein

said flywheel turns said generator.

246. (Original) The engine of claim 244, wherein at least a portion of said electrical energy is used in the electrolysis of water to hydrogen and oxygen.

247. (Currently amended) The engine of claim 246, wherein at least a portion of at least one of said hydrogen and oxygen is used in said mixture~~engine~~.

248. (Previously Presented) The engine of claim 216 or 219, wherein a pressure control device is in said engine exhaust.

249. (Previously Presented) The engine of claim 216, wherein at least one of said engine combustion heat energy and said engine exhaust energy is used to heat at least one of a gas and a liquid.

250. (Previously Presented) The engine of claim 249, wherein at least one of the gas is air and the liquid is water.

251. (Original) The engine of claim 250, wherein said exhaust discharge directly into said air or water.

252. (Currently amended) The engine of claim 216 ~~or 230~~, wherein at least a portion of said engine is insulated.

253. (Currently amended) The engine of claim 2[[30]]16, wherein hydrogen is separated from at least one selected from a list consisting of: water, air, nitrogen, oxygen and any combination thereof within said air separation unit.

254 – 257. (Canceled)

258. (Previously presented) The engine of claim 216, wherein the temperature of said engine exhaust is at least partially cooled with the addition of water to said engine exhaust.

259. (Currently amended) The engine of claim ~~256 or~~ 258, comprising jet propulsion.

260. (Currently amended) The engine of claim 216~~, 254, 256~~ or 258, comprising rocket propulsion.

Claims 261 - 341 (Withdrawn)

342. (Currently amended) The engine of claim 216, ~~230, 233 or 234,~~ wherein said engine comprises a turbine.

Claims 343 - 349 (Withdrawn)

350. (Previously presented) The engine of claim 256, comprising jet propulsion wherein said air is stoichiometrically increased in the jet intake for hydrogen thermodynamics and/or to operate with excess air for cooling.

Examiner Objections and Rejections

Examiner Rejection

First, please note new claim 343 has been renumbered to be claim 350 in accordance with rule 126 because there is an original claim 343.

Applicant's Response

Applicant appreciates the Examiner's correction. Applicant apologizes to the Examiner for that error. The renumbering of claim 343 to 350 has been completed by Applicant.

Examiner Rejection

Applicant has argued Tindell teaches a solar energy system with steam generator, which is different from the claimed invention that is not solar energy system. It's noted by making this argument, Applicant does not seem to understand the basis of patent examining. Please note that even though Tindell teaches many more elements than the claimed invention, Tindell does teach the claimed invention. Because Tindell's invention is more detail than the claimed invention or in other words, because the claimed invention is too broad, or at least broader than the Tindell's invention, the claimed invention must be rejected by Tindell based on 35 USC 102(b). The claimed invention is simply an engine burning oxygen and hydrogen with water injection. Tindell teaches more than that including hydrogen storage 22, oxygen storage 21, combustion chamber 33, and water injection 31. Therefore, it's concluded that the rejection based on Tindell is proper and should be maintained.

Applicant's Response

Applicant apologizes to the Examiner for the error in argument to the Examiner regarding the Examiner's 102 rejection based upon Tindell. Applicant has amended independent claim 216 so as to include a limitation comprising the separation of air into oxygen. Tindell has no teaching or suggestion to separate air into oxygen, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen.

Examiner Rejection

Applicant has argued Hughes teaches an energy storage, electrical source, which is different from the claimed invention that doesn't include those elements. It's noted by making this argument, Applicant does not seem to understand the basis of patent examining. Please note even though Hughes teaches many more elements than the claimed invention, Hughes does teach the claimed invention. Because

Hughes's invention is more detail than the claimed invention or in other words, because the claimed invention is too broad, or at least broader than the Hughes's invention, the claimed invention must be rejected by Hughes based on 35 USC 102(b). The claimed invention is simply an engine burning oxygen and hydrogen with water injection. Hughes teaches more than that including hydrogen storage 20, oxygen storage 22, combustion chamber 24, and water injection 48. Therefore, it's concluded that the rejection based on Hughes is proper and should be maintained.

Applicant's Response

Applicant apologizes to the Examiner for the error in argument to the Examiner regarding the Examiner's 102 rejection based upon Hughes. Applicant has amended independent claim 216 so as to include a limitation comprising the separation of air into oxygen. Hughes has no such teaching or suggestion to separate air into oxygen, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen.

Examiner Rejection

Regarding the 103 rejections, Applicant fails to provide any significant arguments, but only refer back to the arguments of the independent claims. Because the independent claims are properly rejected as noted above, the 103 rejections should be maintained as well.

Applicant's Response

Attached hereto, Applicant repeats his 103 based arguments along with his arguments above which coincide with the claim amendments made herein.

Examiner Rejection

Applicant has requested evidences for the hydrogen gels and propulsion rocket engine. The Examiner would like to provide two US patents to support his rejection. US 2406605 (Hurd et al) discloses the concept of converting hydrogen into hydrogen gel by treating the hydrogen in the dry condenser, note example 4 in column 3. US 6212876 (Gregory et al) teaches a rocket propulsion engine using combustion engine.

Applicant's Response

Applicant would like to respectfully present to the Examiner that the '605 patent does not teach or suggest the claimed invention. Specifically, claim 242 claims:

242. The engine of claim 216, wherein at least one of said hydrogen and oxygen is

stored in a mixture with frozen water crystals to form a gel.

'While claim 216 now claims:

216. An engine comprising a combustion camber, wherein a mixture of oxygen, as O_2, and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air, wherein

the separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

There is no such teaching or suggestion in Example 4 of the '605 patent which states in column 3:

Example 4

Methyltrichlorosilane in vapor form (density= 1.27) together with hydrogen chloride gas was passed in 2:1 ratio over aluminum granules at 350°. A liquid product of density 1.25 was condensed from the reaction products by means of a Dry-Ice condenser. Hydrolysis of a portion of this product gave a gel which upon treatment with alkali solution reacted with a vigorous evolution of gas. Distillation of the product revealed the presence of compounds more volatile than methyltrichlorosilane, which compounds were found to contain larger amounts of Si-bonded hydrogen than the gel.

Therefore, the '605 patent does not teach or suggest instant claim 242.

Applicant would also like to respectfully present to the Examiner that while the '876 patent does teach a combustion chamber and does teach the use of LOX (liquid oxygen), the '876 patent teaches the use of hydrocarbon fuels while having no teaching as to the use of a hydrogen fuel. In strong contrast to the '876 patent, the instant claims teach the use of a hydrogen fuel. Again, as the '876 teaches hydrocarbon fuels, specifically, col. 5 states:

Liquid oxygen (LOX) and cooled liquid propane (LPG) are desirably employed as the oxidizer and fuel, respectively, in the propulsion system. Other thermally compatible fuel/oxidizer combinations may also be desirable, such LOX and liquid methane. Although LPG is liquid at higher temperatures than LOX, it may be maintained at the same temperature and pressure as LOX, eliminating the need for thermal insulation, simplifying tank design, and allowing both the fuel and the oxidizer to act as coolant fluids, rather than the oxidizer alone. LPG at LOX temperatures has negligible vapor pressure, increasing the available suction head at the LPG pump and thus reducing its tendency toward cavitation. The LOX and cooled LPG thus can both provide cryogenic coolant to the cooling passages surrounding the combustion chamber, providing a large thermal gradient and resultant good cooling capacity. Since both LOX and LPG can be used at the same temperature, no insulation is required in the engine (and pump) thus lightening, strengthening, and simplifying it. This allows a higher velocity and thus a higher developed pressure.

Other fuels are possible, for example, silane, ethane and methane are suitable for use with LOX. Other higher temperature oxidizers and fuels are possible, but they require the use of higher temperature materials, which materials have other tradeoffs, e.g. lower thermal conductivity. Variations of fuels and oxidizers necessitate corresponding temperature and pressure variations in tankage and engines, as understood in the art.

Therefore, the '876 patent does not teach or suggest the instant claims.

Examiner Rejection

Claims 216-220, 222, 224, 238-240, 243, 248-254, 256, 258, 342, are rejected under 35 U.S.C. 102(b) as being anticipated by US 4841731 (Tindell).

Tindell discloses a solar energy system comprising an electrolysis chamber **13** for forming hydrogen being stored in a hydrogen tank **22**, oxygen being stored in an oxygen tank **21**, a combustion chamber **33** for burning said hydrogen and oxygen, water input nozzle **31** for injecting water into the combustion chamber, said combustion chamber is then acting as a steam generator to generate steam to drive a steam turbine **47** to generate electricity through a generator **48**.

Applicant's Response

In response, Applicant would like to respectively present to the Examiner that Tindell does not teach the separation of air, wherein said air separation is powered by and performed to obtain

oxygen for an engine combusting hydrogen and oxygen.

In contrast to Tindell, instant claim 216 has been amended to state:

216. An engine comprising a combustion camber, wherein a mixture of oxygen, as O_2, and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air, wherein____

the separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

As applicant has respectfully traversed the Examiner's U.S.C. 102(b) rejection of independent claim 216, Applicant respectfully requests an allowance of independent claim 216, along with dependent claims 217-220, 222, 224, 228-229, 238-240, 243, 248-254, 256, 258 and 342, as said claims are dependant upon base claim 216, which is allowable.

Examiner Rejection

Claims 216-220, 222, 224, 228-229, 238-240, 243, 248-254, 256, 258, 342, are rejected under 35 U.S.C. 102(b) as being anticipated by US 3459953 (Hughes et al).

Hughes et al discloses a solar energy system comprising an electrolysis chamber 16 for forming hydrogen being stored in a hydrogen tank 20, oxygen being storied in an oxygen tank 22, a combustion chamber 24 for burning said hydrogen and oxygen, water imput nozzle 48 for injecting water into the combustion chamber, said combustion chamber is then acting as a steam generator to generate steam to drive a steam turbine 32 to generate electricity through a generator 36. Note the electrical input 10 can be from any sources (column 2, lines 15-16), so it's clear that the electricity from the generator 36 can be used too.

Applicant's Response

In response, Applicant would like to respectively present to the Examiner that Hughes does not teach the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen.

In contrast to Hughes, instant independent claim 216 states:

216. An engine comprising a combustion camber, wherein a mixture of oxygen, as O_2,

and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air, wherein____

the separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

As applicant has respectfully traversed the Examiner's U.S.C. 102 Rejection of independent claim 216, Applicant respectfully requests an allowance of claim 216, along with dependent claims 217-220, 222, 224, 228-229, 238-240, 243, 248-253, 258 and 342, as amended herein and as said claims are dependant upon base claim 216, which is allowable according to MPEP 2143.03.

Examiner Rejection

Claim 223 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5388395 (Scharpf et al). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of nitrogen. Scharpf et al is relied upon to disclose [that] it[']s well known to use nitrogen in the inlet of the combustion chamber for the purpose of improving the cooling function of the input fluid. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to inject nitrogen in Tindell as taught by Scharpf et al for the purpose of improving the cooling function of the input fluid.

Applicant's Response

In response, Applicant would like to present to the Examiner, as presented above, that Tindell does not teach or suggest the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen. In addition, Applicant would like to present to the Examiner that Scharpf et al. describe the use of cryogenic nitrogen from a cryogenic air separation unit, which is in strong contract to Applicant's teaching of oxygen from a cryogenic air separation unit. Specifically, in the Abstract, Scharpf et al. state:

> "The present invention is an improvement to a process for the production of work to generate electricity or to drive a mechanical device using a gas turbine. In the process, feed air stream is compressed and

> combusted with a fuel gas to produce a combustion product. This combustion product is expanded in a gas turbine expander, thereby producing a hot exhaust gas and work. This produced work is used to generate electricity or to drive a mechanical device. The improvement to the process, which increases the work produced by the gas turbine expander, is characterized by **cooling nitrogen product, produced by a cryogenic air separation unit to a subambient temperature and combining this subambient cooled, nitrogen product with the feed air stream prior to compression.** (Emphasis added)

Further, in "Detailed Description of the Invention", Scharpf et al. state:

> The present invention is an improvement to a process for the production of work using a gas turbine either in a simple or a combined cycle configuration. The improvement is particularly suited to the process, wherein at least a portion of the oxygen product produced by the cryogenic air separation unit is reacted with a carbonaceous feedstock in a gasification unit to produce the fuel gas, which is rich in carbon monoxide and hydrogen. The carbonaceous feedstock reacted in the gasifier unit can be coal, petroleum coke, tar sands bitumen, tar sand emulsion, municipal wastes, petroleum residua, waste oil or mixtures thereof.

Therefore, Scharpf et al. teach the use of nitrogen obtained from the cryogenic distillation of air along with the use of said nitrogen at a subambient temperature to cool the combustion of a carbonaceous feedstock such as coal, petroleum coke, tar sands bitumen, tar sand emulsion, municipal wastes, petroleum residua, waste oil or mixtures thereof. Applicant would like to respectfully present to the Examiner that there is no requirement within claim 223 or within claim 216, from which claim 223 depends, for a carbonaceous feedstock or nitrogen at subambient temperature.

As Applicant has respectfully traversed the Examiner's rejection of claim 223, Applicant respectfully requests an allowance of claim 223. Further, as applicant has respectfully traversed the Examiner's U.S.C. 102 Rejection of independent claim 216, Applicant respectfully requests an allowance of dependent claims 223, as claim 223 depends upon base claim 216, which is allowable according to MPEP 2143.03.

Examiner Rejection

Claims 225-227 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5899072 (Gode). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of corrosion to form hydrogen. Gode is relied upon to disclose it's well known to use corrosion to form hydrogen (column 1, lines 36-49). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form hydrogen by corrosion in Tindell as taught by Gode for the purpose of generating more hydrogen if needed.

Applicant's Response

In response, Applicant would like to respectfully present to the Examiner that claims 225-227 depend upon claim 216. As Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claims 225 – 227 by traversing the base claim upon which claims 225 – 227 depend. Accordingly, Applicant respectfully requests an allowance of claims 225 – 227 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claims 230-236 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 5516359 (Kang et al). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of an air separation unit with a membrane. Kang et al is relied upon to disclose it's well known to use air separation unit 107 with membrane 108 for separating air. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use an air separation unit with membrane in Tindell as taught by Kang et al fro the purpose of separating air to form more important components if needed.

Applicant's Response

In response, Applicant would like to present to the Examiner, as presented above, that Tindell does not teach or suggest the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen. In addition, Applicant would like to present to the Examiner that Kang et al. teaches both the combustion of a hydrocarbon fuel and the required membrane separation of air at high temperature, when none of these restrictions are presented within the instant invention or required within instant claims 231-232 and 235. Specifically, in the abstract, Kang et al. state:

> "Oxygen is separated from air by a high temperature ion transport membrane which is integrated with a gas turbine system for energy recovery from the membrane nonpermeate stream. **Air is compressed, heated in a first heating step**, and passed through the feed side of a mixed conductor membrane zone to produce a high purity oxygen product on the permeate side of the membrane zone. Nonpermeate gas from the membrane zone is **heated** in a second heating step and passed through a hot gas turbine for power recovery. The operating temperatures of the membrane zone and the expansion turbine are independently maintained by controlling the rate of **heat addition** in the first and second heating steps, whereby the membrane zone and expansion turbine are thermally delinked for maximum oxygen recovery efficiency." (Emphasis added)

Also, in the "Detailed Description of the Invention", Kang et al. state:

"The present invention comprises several embodiments of a process to recover oxygen from an oxygen-containing gas mixture, preferably air, **at high temperature utilizing a mixed conductor membrane which is heat integrated with a hot gas expansion turbine to maximize the efficiency of energy use in recovering oxygen with the alternate coproducts steam and electricity. The key feature of all embodiments of the invention as described herein is the thermal decoupling of the mixed conductor membrane and the hot gas turbine, which means that each is operated at a temperature which allows the most efficient operation of the combined system.** This is achieved by controlled firing of direct-fired combustors as described in the following specification.

A first embodiment of the invention is given in FIG. 1. Oxygen-containing gas **1**, preferably air, is compressed in compressor **101** to a pressure between 50 and 500 psia, preferably 80 to 300 psia. Compressor **101** is a centrifugal, axial, or reciprocal compressor, optionally multistaged, and optionally intercooled. When operating without intercooling in an adiabatic mode, **compressed feed 3 will be at a temperature of 360 ° to 1,100 ° F.**; when operated with intercooling in an isothermal mode, compressed feed **3** will be at 150 ° to 300 ° F. Compressed feed is optionally preheated in heat exchange zone **103** by indirect heat exchange with hot process stream **5** (later defined) and heated stream **7** passes into direct-fired burner **105**. **This burner is a combustor, for example the type known and used in the gas turbine art, is preferably gas-fired, and utilizes fuel gas 9 which is natural gas, synthesis gas comprising hydrogen and carbon monoxide, refinery fuel gas containing mixed hydrocarbons, or another combustible gas mixture.** Burner 105 is operated with sufficient excess air such that hot combustion stream **11** contains about 10-20 vol % oxygen at a temperature of 800 ° to 2,000 ° F., preferably 1,000 ° to 1,600 ° F. **Stream 11 passes through the feed side of membrane separation zone 107 comprising membrane 108**, preferably a mixed conductor membrane, wherein oxygen diffuses through the membrane driven by an oxygen partial pressure differential in the range of 2 to 80 psi, and high purity oxygen stream **13** containing at least 98 vol % oxygen is withdrawn therefrom at 2 to 30 psia. Hot non-permeate stream **15** is withdrawn at near feed pressure and contains 6 to 18 vol % oxygen. Membrane **108** operates in the temperature range of **800 ° to 2,000 ° F, preferably 1,000 ° to 1,600 ° F.** Membrane separation zone **107** typically is sized and operated such that up to about 90% of the oxygen in membrane feed **11** is recovered as product **13**. (Emphasis added)

In conclusion, Kang et al. does not teach or suggest the combustion of hydrogen, while Tindell does not teach or suggest the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen; therefore, there is no motivation between Kang et al. and Tindell to combine with the other, e.g. MPEP 706.02(j). This is while both Tindell and Kang et al. have teachings and/or requirements which are not found

within the instant claim, e.g. heating a membrane, solar and voltaics.

As Applicant has respectfully traversed the Examiner's rejection of claims 231-232 and 235, Applicant respectfully requests an allowance of claims 231-232 and 235. Further, as Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claims 231-232 and 235 by traversing the base claim upon which claims 231-232 and 235 depend. Accordingly, Applicant respectfully requests an allowance of claims 231-232 and 235 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claim 237 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 4440545 (Weidig). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of corrosion inhibitor. Weidig is relied upon to disclose it's well known to use corrosion inhibitor in a combustion chamber. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use corrosion inhibitor in Tindell as taught by Weidig for the purpose of inhibiting corrosion in the combustion chamber.

In response, Applicant would like to present to the Examiner, as presented above, that Tindell does not teach or suggest the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen. In addition, Applicant would like to present to the Examiner that Weidig teaches the use of a corrosion inhibitor for use in hydrocarbon fuels comprising ethanol. Specifically, in the abstract Weidig states:

> "Liquid fuels for use in internal combustion engines comprising (i) a major fraction of hydrocarbons boiling in the gasoline boiling range, (ii) a minor amount of ethanol, and (iii) a corrosion inhibiting amount of a hydrocarbyl succinic acid or anhydride having from about 8 to 30 carbon atoms."

Also, in the "Description of the Prior Art", Weidig states:

> "Thus, there is presently a need for a corrosion inhibitor that will either curb or prevent the corrosion of conventional systems which are used to store and transport commercial ethanol in gasoline fuel blends and one that will curb or prevent corrosion of the vehicle fuel systems in which these fuels are ultimately used. Further, it is important that the corrosion inhibitor be effective in very small quantities to avoid any adverse effects, such as adding to the gum component of the fuel, etc., as well as to minimize cost. The corrosion inhibitors of the present invention satisfy these needs."

> "U.S. Pat. No. 4,148,605 discloses novel dicarboxylic ester-acids resulting from the condensation of an alkenylsuccinic anhydride with an aliphatic hydroxy acid having from 2 to about

18 carbon atoms and amine salts of said ester-acid as rust or corrosion inhibitors in organic compositions."

"U.S. Pat. No. 4,214,876 discloses improved corrosion inhibitor compositions for hydrocarbon fuels consisting of mixtures of (a) about 75 to 95 weight percent of a polymerized unsaturated aliphatic monocarboxylic acid having about 16 to 18 carbons, and (b) about 5 to 25 weight percent of a monoalkenyl-succinic acid wherein the alkenyl group has 8 to 18 carbons. Also described are concentrates of the above compositions in hydrocarbon solvents, as well as fuels containing the compositions."

And, within the "Summary of the Invention", Weidig states:

"This invention is a fuel comprising a major amount of gasoline, a minor amount of ethanol and a corrosion inhibiting amount of a hydrocarbyl succinic acid or anhydride having from about 8 to 30 carbon atoms."

And, within Example 1, located in the "Description of Preferred Embodiments" Weidig states:

"The results summarized in Table I demonstrate that the **anti-rust compositions of the present invention are effective corrosion inhibitors in the ethanol-gasoline fuel mixtures** at very low concentrations. The results show that those metals and metal alloys exposed to fuels containing a corrosion inhibitor composition of the present invention exhibited a significant reduction in weight loss when compared to like metals and metal alloys exposed to the same fuel blends containing no corrosion inhibitor." (Emphasis added)

In conclusion, Weidig does not teach or suggest the combustion of hydrogen, while Tindell does not teach or suggest the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen; therefore, there is no motivation between Weidig and Tindell to combine with the other, e.g. MPEP 706.02(j).

As Applicant has respectfully traversed the Examiner's rejection of claim 237, Applicant respectfully requests an allowance of claims 237. Further, as Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claim 237 by traversing the base claim upon which claim 237 depends. Accordingly, Applicant respectfully requests an allowance of claim 237 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claim 241 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 3975913 (Erickson). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of fuel cell. Erickson is relied upon to disclose it's well known to use fuel cell **1** to work in combination with an electrolysis chamber. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use fuel cell in Tindell as taught by Erickson for the purpose of generating the appropriate amount of hydrogen and oxygen.

Applicant's Response

In response, Applicant would like to present to the Examiner, as presented above, that Tindell does not teach the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen. In addition, Applicant would like to present to the Examiner that Erickson teaches a gas generator to power a fuel cell. Specifically, in the abstract Erickson states:

> "A gas generator is disclosed which will simply and reliably effect a gas producing reaction between a gaseous and a liquid reactant. The generator can operate at elevated temperatures and has heat exchange means incorporated. The gas generator is applied as a hydrogen generator to an energy conversion system in which hydrogen from the hydrogen-producing reaction powers a fuel cell and the reaction heat from the hydrogen producing reaction powers a thermal engine, thereby enhancing the energy conversion system relative to one in which the hydrogen generator is merely cooled and its heat is rejected as waste heat. Other possible energy conversion systems based on this gas generator are disclosed."

And, in the "Description of the Preferred Embodiments" Erickson states:

> "The basic concept of the gas generator is applicable to the chemical generation of a wide variety of gases, using an even wider variety of chemical reactants. The only stipulation is that at the pressure and temperature of operation (i.e., the bulk temperature of the mass of reactants contained in the generator vessel while the gas generating reaction is occurring) one of the reactants be in the liquid state and one reactant be in the gaseous state. Since the temperature of operation can be anywhere from below ambient to very much above ambient, e.g., 2000.degree.F or even higher, many gas-producing reactants which do not meet the above stipulation at ambient temperature will be in the desired state at some elevated temperature.
>
> "As an example of the above, when the gas generator design is employed as a hydrogen gas generator, the liquid reactant used in the preferred embodiment is a molten metal. The preferred metals for this application are lithium, aluminum, sodium, potassium, magnesium, and calcium, plus the

compound lithium hydride. Any of these can be used individually or in any combination with any of the others. Silicon and beryllium also have the desired properties of displacing hydrogen from steam and having a high energy release per unit weight, but their melting point is too high to be used individually. However, they can be combined with the fuels listed above such that the resulting alloy has a sufficiently low melting point."

Further, Applicant obtained an electronic version of Erickson from uspto.gov and performed a word search within Erickson for the words "liquefaction" and "cooling"; neither "liquefaction" or "cooling" appear within Erickson; therefore, there is no description within Erickson to use a fuel cell to liquefy or cool hydrogen and/or oxygen as presented in instant claim 241. Applicant also performed a word search within Tindell for the words "liquefaction" and "cooling"; these words are not within Tindell. In fact, Tindell teaches pressure storage of hydrogen and of oxygen and discussed above. Claims 216, 239, 240 and 241, as amended herein state:

216 An engine comprising a combustion camber, wherein a mixture of oxygen, as O_2, and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air, -wherein____

the separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

239. The engine of claim 216, wherein at least one of oxygen and hydrogen is stored in at least one of a cooled gas state and a liquid state by liquefaction.

240. The engine of claim 239, wherein compressor(s) for at least one of cooling and liquefaction is powered by at least one of said engine and a fuel cell.

241. The engine of claim 240, wherein said fuel cell is powered by hydrogen and at least one of oxygen and air.

In conclusion, neither Tindell or Erickson teach or suggest the liquefaction or the cooling of hydrogen or of oxygen, much less the use of a fuel cell to perform said liquefaction or cooling; therefore, the combination of Tindell and Erickson do not teach claim 241, much less combine in a

way that teaches or suggests claim 241. This is while Tindell does not teach the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen.

As Applicant has respectfully traversed the Examiner's rejection of claim 241, Applicant respectfully requests an allowance of claim 241. Further, as Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claim 241 by traversing the base claim upon which claim 241 depends. Accordingly, Applicant respectfully requests an allowance of claim 241 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claim 242 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of US 2406605 (Hurd et al). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of gel storage. US 2406605 (Hurd et al) discloses the concept of converting hydrogen into hydrogen gel by treating the hydrogen in the dry condenser, note example 4 in column 3. It would have been obvious at the time the invention was made to a person having ordinary skill in the art t use gel storage in Tindell as taught by Hurd et al for the purpose of ease of storing hydrogen.

Applicant's Response

In response, Applicant would like to present to the Examiner, as presented above, that Hurd et al. does not teach the creation of a hydrogen gel with water. Hurd specifically teaches in Example 4 in column 3:

Example 4

Methyltrichlorosilane in vapor form (density= 1.27) together with hydrogen chloride gas was passed in 2:1 ratio over aluminum granules at 350°. A liquid product of density 1.25 was condensed from the reaction products by means of a Dry-Ice condenser. Hydrolysis of a portion of this product gave a gel which upon treatment with alkali solution reacted with a vigorous evolution of gas. Distillation of the product revealed the presence of compounds more volatile than methyltrichlorosilane, which compounds were found to contain larger amounts of Si-bonded hydrogen than the gel.

Therefore, Hurd et al does not teach clam 242 which claims:

242, The engine of claim 216, wherein at least one of said hydrogen and oxygen is stored in a mixture with frozen water crystals to form a gel.

This is while claim 216 now claims:

216. An engine comprising a combustion camber, wherein a mixture of oxygen, as O_2, and hydrogen, as H_2, are combusted, wherein

at least a portion of said oxygen is obtained by the separation of air, wherein____

the separation of air is selected from the group consisting of: (a) cryogenic air separation, (b) membrane separation, and (c) pressure swing adsorption air separation and any combination thereof, wherein

at least a portion of the energy of combustion powers at least a portion of said air separation, and wherein

the temperature of combustion is at least partially controlled with the addition of water to said combustion chamber in a way that maintains combustion or combustion exhaust temperature.

As Applicant has respectfully traversed the Examiner's rejection, Applicant respectfully requests an allowance of claim 242 as amended herein. Further, as Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claim 242 by traversing the base claim upon which claim 242 depends. Accordingly, Applicant respectfully requests an allowance of claim 242 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claims 259-260, 350, are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of US 6212876 (Gregory et al). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the jet propulsion rocket. US 6212876 (Gregory et al) teaches a rocket propulsion engine using combustion engine. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use jet propulsion rocket in Tindell as taught by Gregory et al for the purpose of driving rocket if needed (note it is well known to use combustion engine such as gas engine to produce thrust in aircraft/rocket design).

Applicant's Response

In response, Applicant would like to present to the Examiner, as presented above, that Tindell does not teach the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen. In addition, Applicant

would like to respectfully present to the Examiner that Gregory does not teach the use of hydrogen as a jet or rocket engine fuel. Again, Gregory specifically teaches in col. 5:

> Liquid oxygen (LOX) and cooled liquid propane (LPG) are desirably employed as the oxidizer and fuel, respectively, in the propulsion system. Other thermally compatible fuel/oxidizer combinations may also be desirable, such LOX and liquid methane. Although LPG is liquid at higher temperatures than LOX, it may be maintained at the same temperature and pressure as LOX, eliminating the need for thermal insulation, simplifying tank design, and allowing both the fuel and the oxidizer to act as coolant fluids, rather than the oxidizer alone. LPG at LOX temperatures has negligible vapor pressure, increasing the available suction head at the LPG pump and thus reducing its tendency toward cavitation. The LOX and cooled LPG thus can both provide cryogenic coolant to the cooling passages surrounding the combustion chamber, providing a large thermal gradient and resultant good cooling capacity. Since both LOX and LPG can be used at the same temperature, no insulation is required in the engine (and pump) thus lightening, strengthening, and simplifying it. This allows a higher velocity and thus a higher developed pressure.
>
> Other fuels are possible, for example, silane, ethane and methane are suitable for use with LOX. Other higher temperature oxidizers and fuels are possible, but they require the use of higher temperature materials, which materials have other tradeoffs, e.g. lower thermal conductivity. Variations of fuels and oxidizers necessitate corresponding temperature and pressure variations in tankage and engines, as understood in the art.

Hydrogen fuel is not found in Gregory.

Therefore, and in conclusion, as Tindell does not teach the separation of air, wherein said air separation is powered by and performed to obtain oxygen for an engine combusting hydrogen and oxygen, while Gregory does not teach the use of hydrogen as a fuel, there is no reason for one of ordinary skill in the art to combine Tindell with Gregory to obtain claims 259-260 and 360.

In further response, Applicant refers the Examiner to page 47 line 22 through page 50 line 14, wherein Applicant in the instant invention has performed an energy balance around a jet engine incorporating the "thrust" equation of jet propulsion. Therein Applicant has presented his discovery of a thermodynamic imbalance of a jet engine operating with a hydrogen fuel which

previously operated with kerosene; Applicant has discovered that for a jet engine to operate with hydrogen as a fuel while providing an about equivalent amount of thrust and combustion temperature that an increase in air is required to maintain thrust and operating temperature, as compared to a kerosene engine. This is while there have been many previous research attempts to develop a hydrogen jet engine, wherein a lack of thrust and a high combustion temperature have always proven to be issues. As stated above, should the Examiner have ANY published information which would rebut or question the information within Applicant's previous declaration, Applicant herein requests that the Examiner please put forth said published information.

As Applicant has respectfully traversed the Examiner's rejection, Applicant respectfully requests an allowance of claims 259-260 and 350 as amended herein. Further, as Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claims 259-260 and 350 by traversing the base claim upon which claims 259-260 and 350 depend. Accordingly, Applicant respectfully requests an allowance of claim 242 as amended herein according to MPEP 2143.03.

Examiner Rejection

Claims 244-247 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4841731 (Tindell) in view of U.S. 6698183 (Thordarson). Tindell discloses all the claimed subject matter as set forth above, but does not disclose the use of flywheel and transmission. Thordarson is relied upon to disclose it's well known to use flywheel 176 and transmission 178 for transmitting power from a combustion chamber/engine 22. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use flywheel and transmission in Tindell as taught by Thordarson for the purpose of transmitting power output of the combustion engine.

Applicant's Response

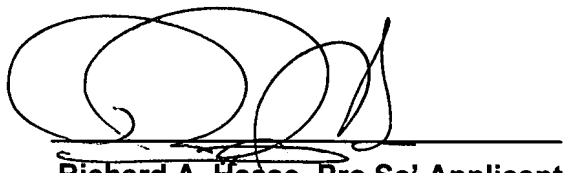
In response, Applicant would like to respectfully present to the Examiner that: claims 244-247 depend upon claim 216. As Applicant has respectfully traversed the Examiner's rejection of claim 216, Applicant has respectfully traversed the Examiner's rejections of claims 244–247 by traversing the base claim upon which claims 244–247 depend. Accordingly, Applicant respectfully requests an allowance of claims 244–247 as amended herein according to MPEP 2143.03.

CONCLUSION

In view of the foregoing, Applicant believes that the claims as presently amended, are in order for allowance; Applicant respectfully request favorable reconsideration of this response and amendment, and allowance of the claims at the earliest opportunity.

In addition, Applicant wishes to inform the Examiner that Applicant presented nearly same set of claims as amended herein (except for jet propulsion, rocket propulsion and hydrogen gel formation) to the Patent Office of Great Britain. While reviewing the same art citations, the British Examiner awarded similar claims to those presented herein (except for jet propulsion, rocket propulsion and hydrogen gel formation). Applicant informs the Examiner of that work, as Great Britain is deemed a competent authority. The issued British Patent is enclosed herein, in its entirety, for the Examiner's review.

Respectfully submitted,



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